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COMOR-D-13/52-20

10 January 1967

MEMORANDUM FOR: Committee on Overhead Reconnaissance

SUBJECT: Color Photography in the National Reconnaissance Program

REFERENCE: COMOR-D-13/52-17

1. The following is a rundown of various actions taken or pending with regard to the use of color photography in the National Reconnaissance Program. Also attached are answers to a cable from the CIA COMOR member, briefed below for your convenience, forwarded by NRO (Tab A) and NPIC (Tab B), respectively.

2. In August (COMOR-M-378, paras 3 and 4), September (M-381, paras 14-16), and October (M-384, paras 8 and 9), COMOR discussed the need for color film in Mission 1037J and to assist in its decision, [redacted]

[redacted] The conclusion of these discussions was to postpone further consideration of the use of color in 1037J to the spring of 1967.

3. On 10 November NRO summarized for COMOR (see reference):

a. The present status of color photography as seen by the NRO,

b. Current and planned color production capabilities within the NRP, and

c. Development efforts currently under way, or planned.

The information contained in this memorandum was extremely helpful. On 6 November the CIA COMOR member cabled a request (OPCEN 0590)

NRO review(s) completed.

[redacted]  
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for additional information. The questions asked are repeated below:

a. What is the cost of the film and decreased film capacity expressed in per cent (due to the increased thickness of the emulsion) for:

(1) One camera of the KH-4 system

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c. Cost of providing the community with color materials as specified by customer requirements as stated in COMOR-D-34/69 of 5 October 1966. If breakdown by customer is possible this information would be appreciated because the requirements for color mission have not been finalized and addition or deletion may occur.

d. Aside from the requirement for additional light, is there any degradation effect on color film caused by weather/atmospheric conditions?

e. At a previous COMOR meeting it was mentioned that some interpreters experience fatigue when looking at stereo pairs one of which is in color. Can you give us some idea of the seriousness of this problem?

f. Accepting the losses in resolution and magnification limits as expressed in COMOR-D-13/52-17, do you believe these losses will significantly extend the time required for complete exploitation?

As stated in the first paragraph, the replies to this cable are attached.

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5. It is requested that all those interested in any aspects of the use of color in either primary or secondary camera systems restudy the papers and information referred to above and be prepared to discuss the use of color in the NRP at the COMOR meeting on 2 March. Should there be questions involving any facts reported in the two attached memoranda, it is urged that those having the questions call either NPIC or NRO, as appropriate. Should the results of this interface produce information that should be made available to other members, this office will be glad to publish a supplement to this memorandum.

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Executive Secretary

Committee on Overhead Reconnaissance

Attachments:

Tabs A and B

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Copies	2, 3	State TCO
	4	DIA [redacted]
	5, 6, 7, 8	DIA TCO
	9, 10	OACSI TCO
	11, 12	ONI TCO
	13, 14, 15, 16	AFNIN TCO
	17, 18	NSA TCO
	19, 20, 21	NRO TCO

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COMOR-D-13/52-20  
Tab A

(16 December 1966)

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## MEMORANDUM FOR CHAIRMAN, COMOR

SUBJECT: Color Film vs Black and White Film

REFERENCE: OPCEN Message 0590, 5 December 1966

The following data comparing color film with black and white is provided per your request:

1. Film Capacity. Color film, having three emulsion layers and a thicker back coating is approximately .6 mil or 15% thicker than normal thin base black and white film. Comparable film capacity data is as follows:

<u>Camera</u>	<u>Color Film</u> (SO-121)	<u>Black &amp; White Film</u> (3404)
One KH-4	13,500 ft	16,000 ft

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2. Film Costs. The estimated film costs listed below [redacted] It should be noted that when using black and white film 38 duplicates are required, and when using color film 12 duplicates are required:

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	<u>Film Costs</u>	<u>Processing Chemicals</u>	<u>Total</u>
<u>One KH-4 Camera</u>			
Color	13,500 ft		
Black & White	16,000 ft		
<u>Duplicates</u>			
12 Color	13,500 ft		
38 Black & White	16,000 ft		

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COMOR-D-13/52-20  
Tab A

[Redacted]

3. Film Distribution. The following is a list of organizations receiving color film copies from KH-4 [Redacted]

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<u>AGENCY</u>	<u>NO. COPIES</u>
NPIC	4
DIA PROD CEN	1
CIA/IAD	1
SAC	1
ARMY/SPAD	1
NRTSC	1
FTD	1
ENGINEERING	2

[Redacted]

4. Weather Effects. Color film imagery is a synthetic dye, which has a tendency to gradually change color characteristics while in storage. This defect is accelerated by increased temperature and humidity or by prolonged exposure to ultraviolet or other strong illumination. However by careful storage and handling it will probably take from 5 to 8 years before serious change occurs. Of more direct consequence is the latent image deterioration of color film after exposure and prior to processing. Should the exposed color film go unprocessed for periods up to 16 days or more we should expect some loss in speed and a reduction in color saturation. However [Redacted] has recently been improved and it is expected that these degradations are no longer serious.

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Information concerning other atmospheric and weather conditions; and interpreter fatigue will be presented separately by NPIC.

/S/

HENRY C. HOWARD  
Colonel, USAF  
Deputy Director for Operations  
NRO Staff

[Redacted]

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COMOR-D-13/52-20  
Tab B

(15 December 1966)

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MEMORANDUM FOR: Committee on Overhead Reconnaissance  
THROUGH: CIA Member, COMOR  
SUBJECT: Color Photography in the National  
Reconnaissance Program  
REFERENCE: A. COMOR-D-13/52-17, 19 November 1966  
B. OPCEN Message 0590 December 1966

1. In reply to Reference B, NPIC has prepared comments on  
paragraphs applicable to its operation.

2. Re paragraph 2d.

a. This paragraph implies that more light is required for the acquisition of color than for black and white photography. Actually the color film used in the programs under discussion requires approximately one-third the light required by [redacted] black and white acquisition material. The quality of the light and not the quantity is the restriction on color acquisition. A single filter-pack has not been developed that will compensate for the "color" of the light at both high and low geodetic latitudes. Camera systems that have the capability of in-flight exposure and filter selection can extend the usefulness of color towards the extremes of geodetic latitudes.

b. Clouds have an adverse affect on the acquisition of all photography. The loss of information in cloud shadows is more pronounced in color photography because of the narrow exposure latitude inherent in color emulsions. Present color materials cannot provide detail in both sun lit and cloud shadow areas.

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Tab B

c. Atmospherics cause scattering and refraction of light. Various wave lengths are affected differently. Filters are used to reduce atmospheric degradations by absorbing those wave lengths most detrimental. The same filters used with black and white emulsions cannot be used with color emulsions which are dependent upon a broader range of wave lengths, thus the atmosphere can cause a greater degradation of color photography than of black and white.

d. The physical chemistry of color film is more significant than degradations introduced by light, weather or atmospheric conditions. The physical size of the chemicals in color emulsions will be a controlling factor as to what scale of color photography will be acceptable for intelligence exploitation. Laboratory and simulated tests have not been conclusive in making this determination.

3. Re paragraph 2e. The comment on interpreter fatigue as a result of viewing stereo pairs, one which is in color, is no longer valid. Through use and familiarity with new type materials (e.g. color) the fatigue that may be initially experienced probably diminishes to a point where it no longer is considered a serious problem.

4. Re paragraph 2F. The inability to achieve large magnifications due to the lesser resolution of color emulsions should not extend the time required to complete first and second phase exploitation; it may possibly reduce the time. The degree to which it would effect third phase exploitation depends on the nature of the intelligence required as well as the level of detail required.

/S/

Assistant for Operations, NPIC

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Copy 1 DCI TCO for USIB/S  
22 TSO CIA  
23 [REDACTED]  
24-33 Asst Ops/NPIC  
34, 35 CIA COMOR Member  
36, 37 CGS  
38, 39 Ch/PWG  
40 Special Center TCO  
41 CGS ReqBr/RecceGrp  
42 D/OSI  
43 DDP TCO  
44 DDS&T [REDACTED]  
45 C/Action/DDS&T  
46 ASA/D/DCI/NIPE  
47 D/OSP  
48 D/OEL  
49 D/SA  
50 D/O/OSA  
51 Intel/O/OSA  
52 SS/OSA  
53 SA/OSA  
54-58 SA(COMOR)/DDS&T

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